

REMARKS

The Office Action mailed July 17, 2006 has been carefully considered. In this final Office Action, Claims 1-8 are pending. Claims 1-8 are rejected. An objection was made to Claims, 2-4, 7-9, 12-14, and 17-19. A new title of the invention was requested. Also, a re-submission of the Information Disclosure Statement, PTO-892, was requested. No claims have been amended in this Office Action. Rejection of these claims is traversed and reconsideration requested in light of the following arguments.

Applicants have submitted an Information Disclosure Statement and form PTO-892 to comply with Examiner's request of resubmission.

Applicants respectfully assert that, based on the arguments with respect to the invention herein, the title is descriptive based on the claims.

Examiner rejected Claims 1 and 5 under the judicially created doctrine of obviousness-type double patenting as being un-patentable over Claims 1 and 7, respectively in Patent No. 6,775,720. Examiner then rejected Claims 3 and 7 under the same doctrine with respect to Patent No. 6,775,720. Applicants have included a terminal disclaimer to remove the Examiner's obviousness-type double patenting rejections of Claims 1, 3, 5, and 7.

Applicants note that Examiner objected to claims, 2-4, 7-9, 12-14, and 17-19. Applicants respectfully remind Examiner that there are only 8 claims in consideration and therefore Applicants will not address the objections to Claims 9, 12-14, and 17-19. Also, Applicants can not address Examiner's objection to claims 2-4 and 7-8 as Examiner did not state a reason for

objection. Applicants therefore respectfully request removal of this objection or, if this objection is to be maintained, clarification as to Examiner's reason for objection to these claims.

Examiner also rejected Claims 1-8 under 35 U.S.C. § 103(a) as being un-patentable over U.S. Patent No. 6,216,202 to D'Errico et al. ("D'Errico") in view of U.S. Patent No. 6,434,637 to D'Errico et al. ("D'Errico et al."). Applicants respectfully argue the 103 rejections should be reconsidered for, as noted in the arguments herein, these references, together or in isolation, do not teach the current invention. These grounds for rejection are hereby traversed and allowance of the claims is requested in view of the following arguments.

Three basic criteria for establishing a prima facie case of obviousness under 35 U.S.C. § 103 are set out at MPEP 2143. First, there must be some suggestion or motivation, either in the reference itself or in the knowledge generally available to one of ordinary skill in the art, to modify the reference. Second, there must be a reasonable expectation of success. Finally, the prior art reference must teach or suggest all the claim limitations.

As set out by MPEP 2143, there must be some suggestion or motivation, either in the reference itself or in the knowledge generally available to one of ordinary skill in the art, to modify the reference. There must also be a reasonable expectation that this modification will succeed. The teaching or suggestion to make the modification and the reasonable expectation of success must both be found in the prior art, not in Applicants' disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991) cited at MPEP 2143.

Per the MPEP 2143.01, "[t]here are three possible sources for a motivation to combine references: the nature of the problem to be solved, the teachings of the prior art, and the knowledge of persons of ordinary skill in the art." *In re Rouffet*, 149 F.3d 1350, 1357, 47

USPQ2d 1453, 1457-58 (Fed. Cir. 1998) (The combination of the references taught every element of the claimed invention, however without a motivation to combine, a rejection based on a *prima facie* case of obvious was held improper.)” Further MPEP states 2143.01 states that “[t]he level of skill in the art cannot be relied upon to provide the suggestion to combine references. *Al-Site Corp. v. VSI Int’l Inc.*, 174 F.3d 1308, 50 USPQ2d 1161 (Fed. Cir. 1999).” Outside the current application, there is no suggestion to combine the above mentioned references and combination of the two references would not yield the current invention.

Applicants’ invention, in general, relates to a method and system for automatically configuring a mass storage system for measuring system performance. The system comprises a plurality of disk storage elements, each element having at least one hyper and connected to a disk storage controller. The disk storage controller is connected to at least one host computer. The host computer defines a plurality of logical units (LUNs) and the storage controller defines in its configuration a front-end hierarchy and a back-end hierarchy. Where the balancing assignments of LUNS across the back-end and marginally balancing assignments of disk drive elements and hypers of the disk drive elements across the back-end hierarchy.

35 USC § 103 Rejections

Grounds for reconsideration of Claim 1, 3, 5, 7

Claims 1, 3, 5, and 7 were rejected based on D’Errico in view of D’Errico et al. Applicants respectfully argue that D’Errico and D’Errico et al., in isolation or in combination, do not teach the invention of Claims 1, 3, 5, and 7. As Examiner has rejected these claims together, for the sake of brevity, Applicants will respond to these rejections in one argument.

Applicants' Claim 1 states:

1. A method for automatically configuring a mass storage system for measuring system performance, the system comprising a plurality of disk storage elements, each element having at least one hyper and connected to a disk storage controller, the disk storage controller being connected to at least one host computer, the host computer defining a plurality of logical units (LUN's), the storage controller defining in its configuration a front- end hierarchy and a back-end hierarchy, the method comprising

balancing assignments of LUN's across the back-end hierarchy, and

marginally balancing assignments of disk drive elements and hypers of the disk drive elements across the back-end hierarchy.

Claim 1 is similar in scope to Claim 3. Claim 3 differs from Claim 1 by replacing "balancing assignments of LUN's across the back-end hierarchy, and marginally balancing assignments of disk drive elements and hypers of the disk drive elements across the back-end hierarchy." with the following claim language:

balancing assignments of components of the back-end hierarchy to LUN's of the front-end hierarchy, and

marginally balancing said assignment.

Claims 5 and 7 are program product claims responding to Claim 1 and 3, respectively.

Therefore, as the Office Action responds to these with one rejection, Applicants respond in kind with one argument.

Examiner asserts that D'Errico discloses a method for automatically configuring a mass storage system for measuring system performance, the system comprising a plurality of disk storage elements, each element having at least one hyper and connected to a disk storage controller, the disk storage controller being connected to at least one host computer, the host computer defining a plurality of logical units numbers the storage controller defining in its configuration a front-end and a back-end hierarchy. Examiner asserts that D'Errico et al. discloses the step of balancing assignment of LUNs across the back-end hierarchy and marginally balancing assignments of disk drive elements across the back-end hierarchy. By combining these references Examiner further asserts that the current invention is anticipated under 35 U.S.C. § 103 and Applicants respectfully disagree.

Applicants respectfully disagree that D'Errico discloses "automatically configuring a mass storage system for measuring system performance." D'Errico teaches a "method of managing a plurality of logical volumes storage devices in a computer system." (D'Errico Column 4 lines 33-35). D'Errico outlines "two independent but related problems" that his invention is meant to fix: 1) that "there is a constraint on the number of target devices that the operating system will support" and 2) that "large number of target devices to be managed by the operating system, which can result in an extremely long boot time when initializing the host computer." (D'Errico Column 3 line 50-60, Column 4 23-25.). To solve these identified

problems, D'Errico then teaches a method to "reduce the number of target devices that must be managed by the operating system on the host computer...[to] significantly reduce the initialization time for the computer system... [as] managing a large number of target devices can significantly slow down the boot time..." (Column 7 lines 10-44).

D'Errico seeks "to reduce the number of target devices" by "combining . . . at least two of the plurality of logical volumes into a virtual volume." D'Errico then "presents[ing] these volumes to the processor as a single logical volume" as well as "presenting the processor with information that enables the processor to deconstruct the virtual volume." (D'Errico Column 4 lines 40-47). D'Errico, in his disclosure, presents a method to address known and identified problems with using "a non-main-frame system" or "intelligent storage system." (D'Errico Column 2 lines 1-12).

The current system teaches a system and method "for automatically configuring a mass storage system for measuring system performance." This is, in general, "a method and apparatus for measuring the performance of a system having a plurality of the disk drive elements controlled through a disk drive controller connected to a plurality of host computers." (Specification Page 1 lines 4-6). A method for measuring performance can be where "the system . . . is measured in terms of input/output (I/O) response times. (Specification Page 1 lines 10-12). D'Errico does not disclose or imply a method for "measuring performance." D'Errico also does not disclose or imply a method to measure the I/O of a system. Rather, his disclosure is a response to a known problem and presents a solution to "manage" this problem by "combining . . the plurality of logical volumes into a virtual volume."

D'Errico's method and teaching is to abstract the devices present from the system. That is, in his virtualization, he seeks to present a reduced amount of devices to the system to manage. Conversely, the current invention, includes "balancing assignments of LUN's across the back-end hierarchy, marginally balancing assignments of disk drive elements and hypers of the disk drive elements across the back-end hierarchy." The balancing of the current invention can not be effectively performed if these devices are hidden to the balancing routine. The automatic configuration that the Office Action asserts D'Errico discloses is different than the automatic configuration of the current invention. D'Errico does not disclose an automatic configuration for "measuring performance," but for managing a known problem by reducing the amount of devices presented to an operating system. "Therefore, "combining the plurality" does not teach or imply does not teach or imply "automatically configuring a mass storage system for measuring system performance."

Applicants agree that D'Errico does not disclose the step of "balancing assignments of LUN's across the back-end hierarchy, and marginally balancing assignments of disk drive elements and hypers of the disk drive elements across the back-end hierarchy" but respectfully assert that D'Errico et al does not cure this deficiency as claimed. D'Errico et al. presents "distributing I/O . . [on] a plurality paths coupling a computer to system resources and said system resource." (D'Errico et al. Column 2 Lines 34-35). Applicants assert that D'Errico et al. does not teach "balancing assignments of LUN's across the back-end hierarchy, and marginally balancing assignments of disk drive elements and hypers of the disk drive elements across the back-end hierarchy."

D'Errico et al. states that he discovered that “the round robin technique employed in conventional multi-path systems does not make effective use of the multiple systems paths, and therefore does not maximize system performance.” (D'Errico et al. Column 3 lines 13-15). To address this problem, D'Errico et al. presents a method of “distribute[ing] each I/O operation . . . based on the status of those previously assigned I/O operations queued”. (D'Errico et al. Column 2 lines 30-40). That is, distribution of “I/O operation to the system paths that is determined to be the shortest path for that I/O operation.” (column 3 lines 56-58). D'Errico et al. states his method functions by determining the “shortest path for that I/O operation, i.e. the path is selected over which the I/O operation is expected to complete most quickly . . . based on the status of those previously assigned I/O operations.” (D'Errico et al. Column 3 Lines 31-31 and Lines 58-61). However, for there to be “previous I/O” operations, there must also have been data transfer before D'Errico et al.'s method can be performed. Therefore, as D'Errico et al.'s distribution is “based on the status of those previously assigned I/O operations,” the method must be performed dynamically. (D'Errico et al. Column 3 Lines Lines 58-61).

Using the “previously assigned I/O operations” to distribute I/O operations between multiple paths, D'Errico et al. does not disclose or imply “balancing assignments of LUN's across the back-end hierarchy, and marginally balancing assignments of disk drive elements and hypers of the disk drive elements across the back-end hierarchy.” D'Errico et al. does not disclose using LUNs or hypers to distribute assignments based on these devices. Rather, D'Errico et al. balances based on dynamic metric, previous “I/O” operations. As the “balancing” of Claim 1 does not “I/O” to be performed, it does not need to be performed as a dynamic balancing routine. The invention of Claim 1, “balancing assignments of LUN's across the back-

end hierarchy” contains no such dynamic limitation and may be performed without data transfer. Therefore distributing dynamically based on “previously assigned I/O operations,” D’Errico et al. does not disclose “balancing assignments of LUN’s across the back-end hierarchy, and marginally balancing assignments of disk drive elements and hypers of the disk drive elements across the back-end hierarchy.”

In addition to being a dynamic routine, balancing based on I/O is different than the invention of Claim 1. Balancing based on “I/O” does not ensure that the “LUN’s [are balanced] across the back-end hierarchy” or that the system “marginally balancing assignments of disk drive elements and hypers of the disk drive elements across the back-end hierarchy.” From the specification, “the back-end is balanced if the hypers associated with any back-end component, such as a DA processor, are mapped as uniformly as possibly across the levels of the front-end hierarchy.” (Specification Page 6 lines 20-22). Since D’Errico et al. uses only previous I/O operations, no such balance is ensured. In D’Errico, the mapping between “hypers associated with any back-end component” is not balanced, rather the assignment of access methods or channel paths to a particular location is distributed or balanced. Balancing of access methods or channel paths, does not ensure that “all the LUNS for one FA . . . are [not] mapped to only a particular hyper and the LUNs for another FA are not mapped to another hyper.” (Specification Page 6 lines 28-29). Rather, D’Errico et al. is for “intelligently balancing the activity performed over multiple system paths to increase system performance.” (D’Errico et al. Column 3 lines 31-33). Therefore, D’Errico et al does not teach or imply “balancing assignments of LUN’s across the back-end hierarchy, marginally balancing assignments of disk drive elements and hypers of the disk drive elements across the back-end hierarchy.”

Applicants also respectfully assert that there is no motivation to combine these references, any combination is only in the benefit of hindsight, and these references do not combine to form the current invention. First, these references together or in isolation do not teach the current invention. Second, combination of D'Errico and D'Errico at all would not increase the function of a system.

The D'Errico disclosure teaches "combi{es}[ing], in the storage system at least two of the plurality of logical volumes into a virtual volume." (D'Errico Column 4 lines 44-46); where in D'Errico the "logical volumes implemented on the storage system are merged into a relatively small number of larger virtual volumes presented to the host." (D'Errico Column 5 lines 51-54). The D'Errico et al. disclosure teaches a "method and apparatus for intelligently balancing the activity performed" by determining the "shortest path for that I/O operation, i.e. the path is selected over which the I/O operation is expected to complete most quickly . . . is based on the status of those previously assigned I/O operations." (D'Errico et al. Column 3 Lines 31-31 and Lines 58-61); where the "selection [of] a path upon the number of queued I/O operations can be implemented in a straightforward fashion in the host computer. (D'Errico et al. lines 35-37). Therefore, D'Errico et al.'s disclosure would require the invention of D'Errico to deconstruct the virtual volumes in order to efficiently balance the system based on "I/O."

D'Errico states that by creating a "single virtual volume . . . target devices can be managed . . by a volume configuration management scheme that deals with only a few devices." (D'Errico Column 9 lines 37-41). D'Errico et al. states that in intelligent storage systems, such as taught in D'Errico, that some of this information, used for managing access methods, is unavailable to the host computer. To then access this information for balancing, "a logging

facility is [must] be provided . . . to create a set of information that provides a more complete picture regarding performance.” Further, the logging information, as disclosed in D’Errico et al. Column 16 lines 14-35, is I/O based information. Claim 1 is performed without this deconstruction and it is also performed without collecting statistics on “previous I/O operations.” While not teaching Claim 1, the combination of D’Errico and D’Errico et al. add unnecessary steps and does not provide the necessary motivation as stated in the Office Action.

Based on the foregoing arguments, Applicants respectfully request reconsideration and removal of the cited 35 USC § 103 rejection for Claims 1, 3, 5, 7. As Claims 2, 4, 6, and 8 are dependant on claims now believed allowable, Applicants also request reconsideration and removal of the rejections for Claims 2, 4, 6, and 8.

Grounds for reconsideration of Claim 2, 4, 6, 8

With respect to claims 2, 4, 6, 8, Applicants incorporate the aforementioned arguments and further argue that D’Errico et al. does not disclose wherein the balancing of assignments across back-end hierarchy maintains the assignment at any level of the back-end hierarchy within one assignment value. As stated above, D’Errico et al.’s algorithm does not consider “balancing assignments of LUN’s across the back-end hierarchy, and marginally balancing assignments of disk drive elements and hypers of the disk drive elements across the back-end hierarchy.”

Rather, D’Errico et al. considers the queuing loads passed on paths that access system resources.

As D’Errico et al. does not balance the same type of devices, it can not “maintain[s] the assignment at any level of the back-end hierarchy within one assignment value.” Further, the balancing taught in D’Errico is different and does not maintain a balance within one assignment value. Specifically, D’Errico et al. teaches if there are eight quickly executing I/O assignments

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assigned to queue B, and only one long executing assignment assigned to queue A, then assignment may be made to queue B with eight quickly executing assignments. (D'Errico et al. Column 5 lines 5-20). This would not balance assignments to be within one assignment value. Therefore D'Errico et al. does not teach wherein "the balancing of assignments across back-end hierarchy maintains the assignment at any level of the back-end hierarchy within one assignment value. Based on the foregoing arguments, Applicants respectfully request reconsideration and removal of the cited 35 USC § 103 rejection for Claims 2, 4, 6, 8.

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Conclusion:

In view of the foregoing, the Applicants' believe that the application is in condition for allowance and respectfully request favorable reconsideration.

In the event the Examiner deems personal contact desirable in the disposition of this case, the Examiner is invited to call the undersigned attorney at (508) 293-7998.

Please charge all fees occasioned by this submission to Deposit Account No. 05-0889.

Respectfully submitted,

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